RMA/IND-EMCAT/DSM-D-02D

Energy Management Consultation and Training Project: Demand-Side Management Technical Assistance Component

DSM Pilot Program for Ahmedabad Electricity Company (Draft)

July 1995

Prepared by: Jennifer Fagan, Niels Wolter, and Ashok Sarkar
Resource Management Associates of Madison, Inc.

Prepared for : United States Agency for International Development (USAID)
New Delhi, India: Contract Number 386-0517-C-00-4100-00
and
Ahmedabad Electricity Company
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1. EXECUTIVE SUMMARY

In March 1994, the Ahmedabad Electricity Company (AEC) was identified as the demonstration site for a Demand-Side Management (DSM) Technical Assistance Program under the USAID-funded, three-year Energy Management Consultation and Training (EMCAT) Project. Resource Management Associates of Madison, Inc. (RMA) is working with AEC to recommend a set of Load and Market Research activities, design and implement a DSM Pilot Program, and develop a five-year DSM Action Plan. This report focuses on the DSM Pilot Program.

AEC is one of three privately owned utilities in India. It is relatively small, with an annual system peak demand of 550 MW. There is currently a large difference (about 100 MW) between AEC's daytime peak loads and nighttime loads. While AEC has enough generation to cover its nighttime loads, it does not have enough to serve its daytime loads and must purchase power from the State-owned Gujarat Electricity Board (GEB). AEC's purchased power cost is about 50% higher than if it were to supply an equivalent amount of power from its own plants. This deficit situation provides AEC with an excellent opportunity to promote DSM programs and activities to its customers in order to reduce the shortfall.

RMA and AEC used multiattribute decision analysis to select the DSM Pilot Program. Under this approach, a large number of DSM programs were evaluated qualitatively against a set of program objectives specified by AEC. The programs were then scored and ranked by a team of eight people from AEC and RMA. AEC's primary DSM program objectives were to:

- Enable AEC to reduce its purchases from the GEB (most important).
- Be highly visible to AEC's customers.
- Be able to be implemented quickly.
- Be relatively easy to administer.
- Promote energy-efficient equipment which is available locally.
- Be replicable throughout India.
- Be easily understood by AEC's customers.
- Apply to AEC's most dominant customer sector.

Using this selection process, the most desirable DSM program combination is an Energy Audit/ Feasibility Study and a Dealer Incentive program for the industrial sector. The audit component of the program will be targeted toward Low-Tension (LT) industrial customers. It is believed that these customers' loads are too small (30 to 70 kW) to benefit from the audit services currently offered by the government and private sector auditing firms. As a result, LT customers do not currently take advantage of audits. The dealer incentive will benefit all industrial customers by providing a financial incentive to local or regional equipment distributors who supply energy- efficient measures (EEMs) to AEC's customers. The amount of the incentive to each dealer will be based, in part, on the volume of EEMs they sell during the first year of the DSM Pilot Program, and on the energy and demand savings resulting from each EEM. RMA and AEC believe that the combination of energy audits, incentives to local equipment dealers to supply and sell EEMs, and financing information will result in an aggressive DSM program which addresses many of the current barriers to implementation of energy efficiency in Ahmedabad.

2. INTRODUCTION

AEC is located in the state of Gujarat in India and is engaged in the generation, transmission and distribution of electricity. In March 1994, AEC was selected for a Demand-Side Management (DSM) Technical Assistance Program under the USAID-funded, three-year Energy Management Consultation and Training (EMCAT) Project. Resource Management Associates of Madison, Inc. (RMA) is the prime contractor the EMCAT – Demand-Side Project, and the Industrial Development Bank of India (IDBI) is the lead Indian counterpart.

RMA is working with AEC to recommend a set of Load and Market Research activities to provide the information needed to develop DSM programs for AEC, as well as to assist with the development of a five-year DSM Action Plan. RMA is also providing technical assistance with designing, developing, and implementing a DSM Pilot Program. The purpose of this document is to describe the DSM Pilot Program in detail and to provide the necessary background materials which support the selection, development, and implementation of this program.

3. INFORMATION ABOUT AEC

AEC is a relatively small, privately owned electric utility. In India, the private utilities are quite small, in contrast to the very large, government-run State Electricity Boards (SEBs) where most of India's power is generated and sold at retail. The private utilities are an ideal place to "jump-start" DSM programs because they are very responsive and can quickly adapt to changing circumstances, unlike the slower, more bureaucratic SEBs. For this reason, a private utility (AEC) was selected for this initiative.

3.1 System Load Characteristics

AEC's annual peak demand is about 540 MW, and its load factor averages around 70 percent. Presently, there is a 100 MW difference between daytime peak loads and nighttime loads. While AEC has enough generation to cover its nighttime loads, it cannot meet its daytime loads and must purchase power from the Gujarat Electricity Board (GEB) at a cost which is about 50 percent higher than AEC's own power. This deficit situation creates an incentive for AEC to promote peak (load) shaving, load shifting, and energy conservation. *Figure 3.1* provides AEC's load curves for typical day-types throughout the year. Day-types which are representative of the four seasons experienced by AEC (i.e., winter, summer, monsoon, and Diwali) are shown. The curves demonstrate the range of load levels and load shapes experienced by AEC throughout the year.

3.2 Sales to Various Customer Groups

During 1994-95, AEC sold 2,373 GWh of electricity to its customers. Industrial sales to High-Tension and Low-Tension customers accounted for the largest share of this total (over 60%, or 1,432 GWh). Commercial, municipal, and residential sales accounted for the remainder. These shares are changing over time as AEC's industrial base is relatively stagnant, while its residential and commercial customer groups are growing rapidly.

Overall, AEC's sales have been growing at between 4 and 5% every year. During 1994, its sales growth was much higher (about 10%) due to above-average growth in the commercial sector. AEC expects this higher growth rate to continue in the future.

The growth rate varies considerably by customer group. Residential and Commercial sales have been growing rapidly, because of significant growth in new end-use loads, new buildings and businesses, and the electrification of rural areas. In contrast, industrial sales have been relatively flat or declining in recent years, because of slumps or stagnation in important industry categories, such as textiles. In Ahmedabad, the textile industry underwent a major recession during the mid-to-late 1980s. Before this recession, industry accounted for more than 70% of AEC's sales and revenues and the majority of its annual sales growth.

Figure 3.1 Ahmedabad Electric Company Load Curves

3.3 Reliability and Losses

Most of AEC's distribution network is underground and therefore, its system reliability is very high. Its losses average 18-20%. Of this amount, 11-12% is from technical losses, and the remainder is attributed to theft and meter error. AEC expects its losses to be higher in the future, because of above-average growth from customers served at lower voltages and to an increase in theft, especially by commercial customers. AEC estimates that the percentage of losses from theft is about 3 to 4% and has undertaken a major initiative to detect and reduce theft. AEC is also researching options to reduce its technical losses.

3.4 Sources of Electricity Supply

AEC has a license to generate power in Ahmedabad and Ghandinagar, the capital of Gujarat. AEC operates two power stations, a newly-constructed, gas-fired combined cycle station rated at 100 MW, and an older, coal-fired generating station. This older station has a total of four generating units. Three of the four are pulverized coal units rated at 110 MW each, and the fourth unit is a 120 MW slag-coal plant, which is being refurbished to a pulverized coal unit. AEC presently operates all of these plants in base-load fashion, as they are not sufficient to cover its peak loads. When AEC's loads drop off at night, the older, more expensive coal-fired units are backed down partially.

Currently, AEC's new 100 MW, gas-fired, combined cycle plant is its most efficient and least cost-generating resource. However, this plant rarely operates above 75 MW because of an inadequate supply of natural gas. AEC is in the process of modifying this plant to add oil (naphtha) storage and dual-fuel capability and expects these modifications to be completed by the third quarter of 1995.

AEC estimates that it needs to add an additional 50 MW per year to address capacity deficiencies because of load growth and plant retirements. Currently, AEC plans to add a new integrated gasification combined cycle plant in 1997-98 at a cost of Rs. 1000 crore ($322.6 million).

As noted previously, AEC purchases a portion (about 12%) of its electricity supply needs from the GEB. These purchases are necessary because AEC lacks enough generation to reliably serve its own loads. However, AEC would prefer to serve 100% of its customers' energy supply needs, since this is less expensive than purchasing power from the GEB.

AEC's purchased power cost averages 50% higher than its own costs of generation. However, the terms under which AEC purchases power are defined by a rather complex tariff schedule and amendments which include an excess demand charge. As a result, AEC's purchased power cost varies considerably by time-of-use. Purchased power costs are highest during the dry summer season when the GEB's peak loads are highest because of high agricultural pumping loads. During those hours of the month when AEC is subject to excess demand charges, its purchased power cost is several times higher than the other hours of the month. *Figure 3.2* explains the terms of AEC's purchased power tariff and amendments.

Figure 3.2 Terms of GEB Tariff

RATE EL-1 (GRID TARIFF) (Applicable to licensees and sanction holders permitted to supply power to public.)

DEMAND CHARGES - Effective from May to October every year.

(a) For supply at voltages 3.3 kv, 11 kv, 22 kv, and 33 kv.

(i) For Billing Demand up to the Contract Demand
$1.42 (Rs. 44) per KVA per month for the first 500 KVA of billing demand
$1.68 (Rs. 52) per KVA per month for the next 9500 KVA of billing demand
$1.81 (Rs. 56) per KVA per month for billing demand in excess of 10,000 KVA

(ii) For Billing Demand in excess of the Contract Demand
$2.65 (Rs. 82) per KVA per month

(b) For supply at voltages above 33 kv.

(i) For Billing Demand up to the Contract Demand
$1.48 (Rs. 46) per KVA per month for the first 500 KVA of billing demand
$1.65 (Rs. 51) per KVA per month for the next 9500 KVA of billing demand
$1.77 (Rs. 55) per KVA per month for billing demand in excess of 10,000 KVA

(ii) For Billing Demand in Excess of the Contract Demand
$2.65 (Rs. 82) per KVA per month

DEMAND CHARGES - Effective from November to April every year

(a) For supply at voltages 3.3 kv, 11 kv, 22 kv, and 33 kv.

(i) For Billing Demand up to the Contract Demand
$1.65 (Rs. 51) per KVA per month for the first 500 KVA of billing demand
$1.81 (Rs. 56) per KVA per month for the next 500 KVA of billing demand
$1.87 (Rs. 58) per KVA per month for the next 9000 KVA of billing demand
$2.00 (Rs. 62) per KVA per month for billing demand in excess of 10,000 KVA

(ii) For Billing Demand in excess of the Contract Demand
$4.10 (Rs.127) per KVA per month

(b) For supply at voltages above 33 kv.

(i) For Billing Demand up to the Contract Demand
$1.61 (Rs. 50) per KVA per month for the first 500 KVA of billing demand
$1.77 (Rs. 55) per KVA per month for the next 500 KVA of billing demand
$1.84 (Rs. 57) per KVA per month for the next 9000 KVA of billing demand
$1.97 (Rs. 61) per KVA per month for billing demand in excess of 10,000 KVA

(ii) For Billing Demand in Excess of the Contract Demand
$4.10 (Rs. 127) per KVA per month

Figure 3.2 Terms of GEB Tariff (continued)

In case of demand recorded over the contract demand fixed for a particular period, the excess demand charges will be payable as per the grid tariff EL-1 on the following basis:

Number of days in a month for which contract demand is exceeded		Rate of excess demand charges payable
(a)	1 to 5 days	0.17 x excess demand charges of GEB's EL-1 tariff
(b)	6 to 10 days	0.33 x excess demand charges of GEB's EL-1 tariff
(c)	11 to 15 days	0.50 x excess demand charges of GEB's EL-1 tariff
(d)	16 to 20 days	0.66 x excess demand charges of GEB's EL-1 tariff
(e)	21 to 25 days	0.83 x excess demand charges of GEB's EL-1 tariff
(f)	More than 25 days	Full excess demand charges as per EL-1 tariff of GEB

ENERGY CHARGES - Effective from May to October every year

(a) For supply at voltages 3.3 kv, 11 kv, 22 kv, and 33 kv.

$.0116 (36 paise) per unit for the first 5000 units consumed during the month
$.0136 (42 paise) per unit for the next 200 units per month per KVA of billing demand
$.0129 (40 paise) per unit for the next 100 units per month per KVA of billing demand
$.0116 (36 paise) per unit for all additional units consumed during the month

(b) For supply voltages above 33 kv.
$.0116 (36.00 paise) per unit for the first 5000 units consumed during the month
$.0134 (41.50 paise) per unit for the next 200 units per month per KVA of billing demand
$.0127 (39.50 paise) per unit for the next 100 units per month per KVA of billing demand
$.0115 (35.50 paise) per unit for all additional units consumed during the month

ENERGY CHARGES - Effective from November to April every year

(a) For supply at voltages 3.3 kv, 11 kv, 22 kv, and 33 kv.

$.0123 (38 paise) per unit for the first 5000 units consumed during the month
$.0145 (45 paise) per unit for the next 200 units per month per KVA of billing demand
$.0123 (38 paise) per unit for the next 100 units per month per KVA of billing demand
$.0116 (36 paise) per unit for all additional units consumed during the month

(b) For supply voltages above 33 kv.
$.0123 (38.00 paise) per unit for the first 5000 units consumed during the month
$.0144 (44.50 paise) per unit for the next 200 units per month per KVA of billing demand
$.0137 (42.50 paise) per unit for the next 100 units per month per KVA of billing demand
$.0121 (37.50 paise) per unit for all additional units consumed during the month

3.5 Average Rate Levels

During 1994, AEC's customers paid an average of 1.96 Rupees (about 5.5 cents) for each kWh they consumed. However, average rate levels are significantly different by customer group. Residential rates average about 1.36 rupees per kWh (about 4 cents), while commercial and industrial rates are substantially higher (about 2 rupees or 6 cents per kWh). Agricultural rates are heavily subsidized and, consequently, very low (about 0.6 rupees or 2 cents per kWh).

Within each tariff, the energy charges are in increasing blocks. Or, as usage levels rise, average energy charges also rise. As a result, average rates differ for customers on the same tariff who consume different amounts of energy. The most variance is under the Residential (RGP) tariff, where the energy charge ranges from a low of 0.37 rupees (about 1 cent) per kWh for the first 25 kWh used per month to a high of 1.60 rupees (about 5 cents) per kWh for all kWh consumed in excess of the first 100 kWh. A summary of the specific charges contained in AEC's main tariffs is provided in *Table 3.1*.

Table 3.1 Summary of Charges in AEC's Main Tariffs

Tariff Schedule	Fixed Charge/Demand Charge		Energy Charge	
Residential - RGP	For single-phase supply For three-phase supply	$.064 (Rs. 2.00) / month per installation $.161 (Rs. 5.00) / month per installation	(I) For a monthly consumption up to 200 units For first 25 units consumed/month For next 25 units consumed /month For next 50 units consumed/month For next 100 units consumed/month (ii) For a monthly consumption above 200 units For first 100 units consumed/month For next 100 units consumed/month For next 100 units consumed/month Remaining units consumed/month	$.0119 (37.0P)/unit $.0126 (39.0 P)/unit $.02584(80.0 P)/unit $.0284 (88.0 P)/unit $.0258 (80.0 P)/unit $.0323(100.0 P)/unit $.0403(125.0 P)/unit $.0516(160.0 P)/unit
Commercial - CGP	For single-phase supply For three-phase supply	$.645 (Rs. 20.00)/ month per installation $1.45 (Rs. 45.00) / month per installation	For first 50 units consumed/month For next 50 units consumed/month For next 100 units consumed/month Remaining units consumed/month	$.0484(150.0 P)/unit $.0548(170.0 P)/unit $.0597(185.0 P)/unit $.0677(210.0 P)/unit
Small Motors - LTP (up to 5 B.HP.)	Fixed charges per month per B.HP. of connected load	$.387 (Rs. 12.00)/ B.HP./month	Flat rate of	$.0342(106.0 P)/unit
Small Motors - LTP (5 to 15 B.HP.)	Fixed charges per month per B.HP. of connected load	$.483 (Rs. 15.00)/ B.HP./month	Flat rate of	$.0342(106.0 P)/unit

Tariff Schedule	Fixed Charge/Demand Charge		Energy Charge	
Large Motors - LTMD (above 15 B.HP.)	a) For Billing Demand up to and including Contract Demand - First 50 kW of Billing Demand/ month - Next 30 kW of Billing Demand/ month - Rest of Billing Demand/ month b) For Billing Demand in Excess of the Contract Demand - Fixed Charge per kW of Billing Demand/ month	 $2.10 (Rs. 65.00)/kW $2.58 (Rs. 80.00)/kW $3.23(Rs.100.00)/kW $10.48(Rs. 325.00)/ kW	For the Billing Demand up to and including 50 KW For the Billing Demand above 50 kW	$.0390(121.0 P)/unit $.0439(136.0 P)/unit
High Tension HTMD-1 (Demand of 100 to 300 kW)	a) For Billing Demand up to and including Contract Demand Fixed charge per kW of Billing Demand/month b) For Billing Demand in excess of the Contract Demand Fixed charge per kW of Billing Demand/month	 $2.90 (Rs. 90.00)/kW $7.25 (Rs. 225.00)/kW	Flat Rate of Time of Use Charge for the consumption during specified hours as follows: Period Specified Hours March - Sept 10 a.m. - 6 p.m. Oct - Feb 2 p.m. - 10 p.m.	$.0445(138.0 P)/unit $.0032(10.0 P)/unit
High Tension HTMD-2 (Demand above 300 kW)	a) For Billing Demand up to and including Contract Demand - First 1000 kW of Billing Demand/ month - Next 2000 kW of Billing Demand/ month - Rest of the Billing Demand/month b) For Billing Demand in excess of the Contract Demand Fixed charge per kW of Billing Demand/month	 $2.97 (Rs. 92.00)/kW $2.94(Rs. 91.00)/kW $2.90(Rs. 90.00)/kW $6.45(Rs. 200.00)/kW	First 400 units consumed/month/kW of Billing Demand Remaining units consumed per month Time of Use Charge	$.0487(151.0 P)/unit $.0465(144.0 P)/unit $.0032 (10.0 P)/unit

Tariff Schedule	Fixed Charge/Demand Charge		Energy Charge	
High Tension Optional (Maximum Demand above 100 KVA)	a) For Billing Demand up to and including Contract Demand		First 380 units consumed/month/KVA of Billing Demand	150.0 P/unit
	- First 1000 KVA of Billing Demand/month	$2.74(Rs. 85.00)/KVA	Remaining units consumed per month	143.0 P/unit
	- Next 2000 KVA of Billing Demand/month	$2.71(Rs. 84.00)/KVA	Time of Use Charge	10.0 P/unit
	- Rest of the Billing Demand/month	$2.68(Rs. 83.00)/KVA		
	b) For Billing Demand in excess of the Contract Demand Fixed charge per KVA of Billing Demand in excess of the Contract Demand/month	$6.29(Rs. 195.00)/ KVA		

4. END-USE EQUIPMENT SATURATION SURVEY

Historically, AEC has done relatively little customer research, compared with similar utilities in the U.S. In 1991, AEC retained Span Associates, a local market research firm, to complete a detailed customer survey. This survey queried a cross-section of 10,000 to 15,000 of AEC's residential, commercial and industrial customers on the quality and reliability of electric service supplied by AEC and requested suggestions for improvements. Many of the recommendations in the survey have already been implemented by AEC. AEC has also undertaken a detailed analysis of its historical sales and demand data (from customer billing records) and has sorted this data by type of business or industry. The purpose of this analysis was to assist AEC with its theft detection efforts; however, this analysis is also very useful for the design of DSM programs, since customers within the same types of businesses or industries use energy in the same or similar ways.

While the results of these customer research efforts were helpful for the design of DSM programs, they, alone, were not adequate. Further research is needed to determine how AEC's customers are currently using electricity and, specifically, the characteristics of energy-using equipment presently used by the customer. Absent this information, RMA and AEC would need to rely on data from other research efforts (at other utilities in India), if it were available, and would need to assume that AEC's customers used energy in the same manner as these other utilities' customers. Such assumptions could lead to a DSM Pilot program which does not suit the needs of AEC's customers. If this were the case, AEC would lose credibility with its customers and would need to spend valuable time and money to redesign and reimplement the revised DSM Pilot program.

To avoid this undesirable outcome, AEC agreed to undertake detailed end-use equipment saturation surveys for all of its major customer groups. During 1994, RMA and AEC developed survey forms for the three major customer groups: residential, commercial and industrial. Survey forms for the industrial sector are provided in Appendix A.

In each of the surveys, AEC's customers provide three main types of information:

- Descriptive statistics about their businesses or homes (e.g. facility size, number of employees or residents, and hours of operation or occupancy)

- Data on end-use equipment operated by the customer (e.g. type of equipment, size, quantity, and rated capacity, etc.)

- Decision criteria which they use when purchasing energy-using equipment

Because the industrial sector is the dominant part of AEC's sales and revenues, AEC elected to administer this survey to its two categories of industrial customers first. AEC has been assisted with this effort by Span Associates (HT industrial) and Professor Vyas, an engineering professor from the local university (LT industrial). AEC plans to eventually survey its residential and commercial customers as well.

The general findings from the LT and HT industrial customer surveys returned to date are as follows:

Descriptive Statistics (LT and HT)

AEC TO PROVIDE

Major Types of Energy-Using Equipment (LT and HT)

AEC TO PROVIDE

Criteria for Purchasing Energy-Using Equipment (LT and HT)

AEC TO PROVIDE

Detailed reports on the survey findings and recommendations for LT and HT industrial customers are available from AEC.

5. PROCESS USED TO SELECT DSM PROGRAMS

5.1 Background

During RMA's second trip to AEC, in September 1994, a list of DSM objectives was jointly developed by RMA and AEC. Some of these objectives were based on AEC's corporate goals and their short-term and long-term plans, while others were more directly related to DSM program implementation requirements. RMA and AEC also prepared a list of DSM program alternatives for each major customer sector: residential, commercial, HT industrial, and LT industrial. These prototypical programs are candidates for eventual implementation by AEC during the next several years. The program designs for the DSM Pilot Program as well as the programs to be included in the Five-Year DSM Action Plan were selected from this list of prototypical programs.

The process of selecting a subset of DSM programs from this broader list requires the decision maker to trade-off fulfillment of one DSM objective against others. This is because alternative DSM programs have varied potential for fulfilling the DSM objectives. DSM programs that can fulfill one objective may fail to meet another. Normally, multiple objectives need to be considered as DSM program choices are made. An approach called multiattribute decision analysis allows one to systematically evaluate the trade-offs between multiple objectives as DSM programs are being evaluated.

Multiattribute decision analysis is an approach which involves <u>qualitative</u> rather than <u>quantitative</u> screening of alternatives. There are two reasons why it was necessary to use a qualitative method to select DSM programs for AEC:

(1) Many of AEC's DSM objectives are of a more qualitative nature.

(2) There is a general lack of quantitative data specific to AEC and its customers.

As discussed previously, AEC is presently involved in several research activities designed to provide quantitative data for future use in selecting, designing and implementing the DSM programs. The results of this research are being incorporated into the design of the DSM programs as they become available, but they were not available during the DSM program selection process.

5.2 Multiattribute Decision Analysis Method

Multiattribute decision analysis is used in situations where decisions must be made based on satisfying more than one objective amd where some or all of the objectives are qualitative. The central focus of this approach is the quantification, display, and resolution of trade-offs that are required when objectives conflict.

The multiattribute decision analysis process (applied to DSM program selection) involves several steps:

- Identifying and defining attributes
- Mapping attributes to DSM programs
- Scoring DSM programs against each attribute
- Developing weights reflecting the relative importance of each attribute
- Calculating a weighted score for each program and each attribute and summing the weighted scores to calculate a total score

5.3 DSM Program Attributes

A total of twelve attributes were identified and discussed by AEC and RMA. Of these twelve, only nine were formally considered in the final multiattribute decision analysis process. The attributes are based on the requirements of AEC and USAID. AEC is most interested in reducing their purchased power costs and choosing a visible and relatively simple DSM pilot program. USAID is primarily interested in DSM programs which have rapid results, are highly visible, and have wide applicability. The three attributes not considered in the analysis – Cost of DSM Program to Utility, Cost of DSM to Customer, and Cost-Effectiveness of DSM Program to Utility – require quantitative data from AEC's ongoing research efforts before they can be formally considered in the decision process. At the time the DSM Pilot Program was selected and designed, this data was not available.

The nine attributes that are considered in the decision process are as follows:

- *Power Purchases* – This attribute relates to AEC's number-one objective for DSM programs – namely, that they enable AEC to reduce its power purchases from GEB. For a program to score highly against this attribute, it must provide savings during those periods when AEC is experiencing a capacity deficit. However, the program should not save energy at other times (e.g., at night) when AEC does not need to purchase power from GEB.

- *Impact Visibility* – This objective reflects the desire of AEC and USAID to have the program be highly visible to its customers and the public in general.

- *Lead-Time* – This attribute concerns the time required before the program has a significant and visible savings impact. Some programs, such as direct load control, produce savings immediately, while others, such as information programs, take much longer to provide meaningful savings, and the savings cannot be easily quantified. Short lead-time programs are desired.

- *Implementation* – This objective refers to the ease of implementing and administering a program. This is an important attribute for a utility such as

AEC, which is relatively inexperienced with DSM program development and implementation activities. This attribute will be less important over time as AEC becomes more experienced with DSM program administration.

- *Equipment & Data* – This is one of the most important attributes. It encompasses both the ease of obtaining information about EEMs and the ease of purchasing EEMs locally. Programs which rely on locally available EEMs will fail if the equipment (and information about the equipment) is not readily available.

- *Replicability* – This attribute refers to the requirement that the DSM pilot program be applicable throughout India, so that its success can be repeated at other Indian utilities in the future. Programs which are not generic, but are specific to a particular type of business or customer, will not perform well against this attribute.

- *Understandability* – This objective relates to the need for DSM programs to be easily understood by customers to facilitate their acceptance of and participation in the programs. Again, as AEC and its customers gain experience with DSM, this attribute becomes less important.

- *Acceptance* – In general, programs which have a high probability of being widely accepted by customers should be chosen. As noted above, this attribute is partially a function of the program's understandability.

- *Snapback* – This attribute relates to the fact that a reduction in a consumer's energy costs, because of more efficient energy use, sometimes leads to a higher level of energy use by the customer. This reduces the program's energy savings and energy cost-related benefits. Certain types of DSM programs are vulnerable to snapback; these programs should be avoided by AEC.

5.4 Development of DSM Program Alternatives

The set of final DSM program designs to be considered in the multiattribute decision analysis process was developed over a six-month period. First, an extensive list of preliminary DSM program ideas was developed during RMA's second visit to AEC, in September 1994. Between four and eight DSM program concepts were developed for each major customer sector. Many of the initial program design selections were made based on the general preferences of AEC's staff, as well as the most important DSM objectives stated by AEC's management. This set of prototypical DSM programs was refined in late 1994 and early 1995, based on discussions between RMA and AEC.

During RMA's third visit to AEC, in February 1995, the set of DSM program designs was finalized and the multiattribute decision process was used to select the DSM Pilot Program and the programs to be contained in AEC's Five-Year DSM Action Plan. The final set of DSM programs considered was as follows:

Residential Sector:

- Customer Education and Energy Audit Program
- New Construction Education Program
- Customer Rebate Program for Purchases of High-Efficiency Refrigerators and Air Conditioners
- Dealer Incentive Program

Multi-Family Sector (Apartment Buildings):

- Customer Education Program
- Residential Manager Training and Contest Program
- Rebate Program for Equipment (such as Elevators) in Common Areas
- New Construction Education Program
- New Construction Rebate Program

Commercial Sector:

- Retail Store Demonstration Program
- Lighting Rebate Program
- Energy Audit/Feasibility Study Program
- New Construction Education Program
- New Construction Rebate Program
- Newsletter/Information Program
- Direct Install Program (Using ESCOs)

Industrial Sector (LT Customers):

- Energy Audit/Feasibility Study Program
- Custom Rebate Program
- Dealer Incentive

Industrial Sector (HT Customers)

- Energy Audit/Feasibility Study Program
- Major Accounts Program

- Custom Rebate Program
- Motor Rebate Program
- Dealer Incentive Program
- Efficient Motor Rewinding Dealer Incentive Program

Load Control and Pricing Programs:

- Backup Generator Peak Control (Industrial)
- Backup Generator Peak Control (Commercial)
- Direct Load Control of Flour Mills (Commercial)
- Direct Load Control of Air Conditioners and Evaporative Coolers (Commercial)
- Interruptible Tariff (Large Commercial and Industrial)
- Time-of -Day Rates (Large Commercial and Industrial)

Descriptions of the main features of these programs are provided in Appendix B.

5.5 DSM Program Selection Process

DSM programs were scored and ranked using the multiattribute decision analysis approach. Eight people were involved in the scoring and ranking process – four from RMA and four from AEC. Each person was asked to score each program against the nine qualitative attributes discussed earlier. In addition, persons were asked to assign weights to each of the nine attributes so that the relative value of each score could be quantified and a weighted score could be calculated.

Individual scores were developed based on each person's assessment of each program. To facilitate the scoring process and make it less subject to bias, five discrete values were used by the participants – 0, 0.25, 0.50, 0.75, and 1.0. To eliminate possible bias associated with differences in the number of responses from each organization, the scores were normalized on a scale of 1 to 100 so that the results could be combined and evaluated.

Table 5.1 reports the results of the multiattribute decision process. The first column (with quantitative results) contains the normalized scores. The second and third columns provide the ranking of each program and the overall rank, respectively, based on the normalized scores. In the fourth, fifth and sixth columns, sector weights have been assigned to reflect the relative importance of each sector to AEC's overall sales. The largest weight is assigned to the industrial sector, since it accounts for the largest proportion of AEC's total energy sales. Thus, columns five and six report sector-weighted scores and overall ranks.

5.6 Final Selection of DSM Pilot Program

As the final results of the multiattribute ranking show, the industrial sector is the most important sector to target for DSM Pilot Program development and implementation. All programs for the Industrial - HT sector received the highest ranks, because the sector is the most dominant in terms of AEC's overall sales. The highest-ranked program is the Energy Audit/Feasibility Study program for Industrial HT customers. However, AEC believes that its HT customers already take advantage of energy auditing services provided by EMC, CII, and others. On the other hand, LT customers do not participate in these programs. Also very highly ranked is the Dealer Incentive Program for both HT and LT industrial customers. It is logical to combine these two programs into one to form an aggressive, comprehensive DSM Pilot Program.

Table 5.1 Multiattribute Decision Analysis Results

DSM PROGRAM OPTIONS	**Total Value (Normalized)** scale: 1-100	**Rank within Sector**	**Overall Rank** sector-neutral	**Sector Weight (% sales)**	**Program Value** sector-weighted	**Overall Rank** sector-weighted
Residential						
Customer Education & Energy Audits	85.64	1	5	0.23	19.70	11
New Construction Education	85.20	2	6	0.23	19.60	12
Dealer/Retailers' Education	82.75	3	11	0.23	19.03	14
Dealer Incentive Rebate	77.11	4	15	0.23	17.73	16
Customer Rebate	65.35	5	24	0.23	15.03	17
Multi-Family (Apartment Buildings)						
New Construction Education	88.81	1	1	0.23	20.43	9
Residential Manager Training	87.71	2	2	0.23	20.17	10
Customer Education	84.41	3	7	0.23	19.41	13
Rebate (Common Use Systems)	77.47	4	14	0.23	17.82	15
New Construction Rebate	59.57	5	30	0.23	13.70	31
Commercial						
Retail Store Demonstration	87.58	1	3	0.10	8.76	23
New Construction Education	83.80	2	9	0.10	8.38	24
Newsletter / Information	83.29	3	10	0.10	8.33	25
Energy Audit / Feasibility Study	75.41	4	16	0.10	7.54	27
Lighting Rebate	73.60	5	17	0.10	7.36	28
Direct Install (through an ESCO)	61.59	6	25	0.10	6.16	29
New Construction Rebate	60.93	7	27	0.10	6.09	30
Industrial (Low-Tension)						
Energy Audit / Feasibility Study + Dealer Incentive	83.87	1	8	0.17	14.26	18
Customer Rebate Program	72.43	2	19	0.17	12.31	22
Industrial (High-Tension)						
Energy Audit / Feasibility Study	87.09	1	4	0.40	34.83	1
Motor Rewinding Rebate	72.80	2	18	0.40	29.12	3
Customer Rebate Program	70.48	3	20	0.40	28.19	4
Motor Rebate	65.97	4	23	0.40	34.83	7
Major Accounts Program	61.02	5	26	0.40	24.41	8
Load Control Strategies						
Back-Up Generator Peak Control (Industrial)	79.30	1	12	0.40	31.72	2
Stand-By Generator Peak Control (Commercial)	78.50	2	13	0.10	7.85	26
Time-of-Use Rates	70.29	3	21	0.40	28.11	5
Interruptible Tariff	70.13	4	22	0.40	28.05	6
Direct Load Control (Evaporation Cooling)	60.85	5	28	0.23	14.00	19

DSM PROGRAM OPTIONS	**Total Value (Normalized)** scale: 1-100	**Rank within Sector**	**Overall Rank** sector-neutral	**Sector Weight (% sales)**	**Program Value** sector-weighted	**Overall Rank** sector-weighted
Direct Load Control (Air Cond./Flour Mills)	60.43	6	29	0.23	13.90	20

6. DESCRIPTION OF DSM PILOT PROGRAM

6.1 Overview

The combination Energy Audit/Feasibility Study and Dealer Incentive Program, targeted mainly toward LT industrial customers, was chosen for the DSM Pilot Program. It is believed that these customers' loads are too small (30 to 70 kW) to benefit from the audit services currently offered by the EMC, the CII, Kirloskar, and others. As a result, they do not take advantage of these services. The dealer incentive will benefit all industrial customers by providing a financial incentive to local or regional equipment distributors who supply EEMs to AEC's customers. The amount of the incentive to each dealer will be based on their actual sales of EEMs and the estimated energy and demand savings resulting from each EEm installation. Through this program, AEC will also develop an information package describing locally available financing options. It is believed that this combination of energy audit-based information, incentive to local equipment dealers and financing information will result in an aggressive DSM program which addresses many of the barriers to implementation of EEMs which are currently present in Ahmedabad.

6.2 Advantages of this Program Design

There are several advantages to this combination Energy Audit/Feasibility Study - Dealer Incentive Program.

- First, it focuses on the customer sector which is the most dominant and has the highest potential for saving energy. Industrial customers consume about one-half of the energy sold by AEC and account for more than half of the energy savings potential.

- Second, the audit services provided through this program will supply valuable information to AEC's customers concerning their facility's energy use and cost-effective energy efficiency investments. Lack of this information is a common barrier to the installation of EEMs by these customers, the audit provided under this program is designed to directly address this barrier.

- Third, the dealer incentive should result in EEMs being supplied and promoted by local dealers, thereby eliminating the barrier presented by the lack of locally available EEMs. It is hoped that this incentive will also lead to a long-term change in the type of equipment supplied and aggressively promoted by local equipment dealers. This incentive may also lead to a reduction in the price of the equipment to the consumer. This will occur if dealers seek to maximize sales of EEMs (by increasing the total amount of incentive they qualify for) by lowering the price of the equipment. In this manner, the savings (i.e., the incentive) is split between the dealer and the customers so that both parties are better off.

- Fourth, this program will provide an opportunity for AEC to strengthen its relationships with its industrial customers. This will foster loyalty on the part of AEC's customers which will be especially important for AEC in the future when they face an increasing number of energy supply choices.

- Finally, this program is designed to be cost-effective for AEC compared to its other supply-side alternatives. It will also result in highly cost-effective investments for AEC's customers. Both AEC and its customers will save money relative to "business as usual". In the long-run, this will benefit all of AEC's customers.

6.3 Audit & Feasibility Study Component

Customers who participate in the DSM Pilot Program will be provided with both a detailed energy audit and a feasibility study which assesses the energy conservation opportunities (ECOs) identified during the audit. The purposes of the energy audit are to:

- Understand how the customer currently uses electricity.

- Use this information to identify potential ECOs which are highly cost-effective for the customer.

The feasibility study will provide a detailed written assessment of the feasibility of the ECOs identified through the audit, including both the technical and financial feasibility of the recommended measures, as well as a listing of EEM dealers and local financing sources..

6.3.1. Energy Audit Component

An energy audit is a systematic approach for assessing the existing condition and performance of energy-using systems within the customer's facility. A good energy audit involves a thorough inspection of the energy-using loads within the facility, to provide the following types of information: (1) a breakdown of energy use within the facility, (2) a baseline for future audits, and (3) a prioritized list of ECOs recommended for the facility.

An energy audit has value well beyond its basic use as a means of identifying ECOs. It can also be a powerful energy management tool. Often, facility energy management practices and programs can be greatly improved upon, if the audit addresses issues important to the following types of people:

- *Facility Management personnel* can use information generated by energy audits to perform a detailed accounting of energy use within their facility, develop a priority listing of future energy-efficiency projects, and assist in planning future budgets and expenditures.

- *Operating personnel* can use audit-related information to compare future performance of energy-using systems within the facility against a standard. As electrical equipment ages and its performance degrades, its performance can be compared with that of new equipment. The audit also furnishes information which can be used to establish appropriate equipment maintenance intervals. This same information can also be used to determine when it is appropriate to replace equipment rather than continuing expensive operation and maintenance activities.

- *Building Management personnel* can use audits for establishing energy budgets and costs for tenants and for developing a strategic plan for modernizing the building and facilities so as to ensure their long-term profitability.

The energy audit has two components: pre-audit activities and the energy audit process. Pre-audit activities are intended to provide the audit team with general background information concerning the facility to be audited. The types of data which are collected during this pre-audit phase are those which either directly or indirectly influence the facility's energy use. These include:

- Building Plans which contain general information about the characteristics of the building (e.g., size in square meters, and age).

- Data on equipment for major end-uses (e.g., type of equipment, size, and age).

- Electricity bills for at least the most recent 24 months

- Hours of operation (operating schedules for each type of energy-using equipment)

- Expansion plans

- Renovation plans

The energy audit process involves an in-depth study of the energy-using equipment within the building. The energy audit process builds on the activities conducted during the pre-audit phase, and includes the following steps:

- Verify information on building characteristics, equipment (standard and energy-efficient) inventories, and hours of operation

- Understand the operation of key energy using systems. Review sketches and design data. Collect data relating to temperature, airflow, kW, and power factor, etc., as appropriate

- Identify ECOs which fall into the categories of –
  - Tuning, operation and maintenance
  - Capital investments (i.e., ECOs requiring a capital expenditure which takes more than one year to recover)

- For each ECO, estimate its savings and simple payback period. Perform a detailed energy analysis, which includes standard engineering calculations, cost-benefit assessments, and discounted cash flow analysis

- Develop a set of recommended ECOs ranked in decreasing order of cost-effectiveness and/or simple payback period

6.3.2. Feasibility Study Component

The feasibility study provides a written assessment of the viability of each recommended ECO. Both the ECO's technical and financial feasibility are addressed. The purposes of the feasibility study are to provide the customer with a summary of existing conditions, energy consumption levels, and recommended energy conservation opportunities and provide them with information needed to implement the recommended energy conservation opportunities. The feasibility study is comprised of:

- A detailed description of the facility.
- A summary of the facility's current energy use.
- A description of the history of energy management and energy conservation at the facility.
- A summary of energy conservation opportunities with short (1- to 2-year) and medium (2- to 5-year) paybacks as well as a description of the analysis performed.
- A discussion of energy conservation opportunities with longer paybacks (over 5 years) or those for which plant personnel have a strong interest.
- A set of appendices which contain detailed work papers, including additional calculations, tables, figures, and product literature.

6.3.3. Financial Responsibility for Energy Audit/Feasibility Study

AEC will perform the pre-audit activities at no cost to the customer. However, customers will be expected to pay the full cost of the detailed energy audit and feasibility study. AEC may elect to waive the fee for audit/feasibility study services, provided the customer agrees to install those recommended measures having simple paybacks of three years or less within 12 months of receipt of the feasibility study.

AEC is developing a schedule of standard fees for these services. The fees reflect AEC's labor and equipment related costs associated with carrying out each audit and feasibility study. The total amounts charged the customer will vary according to the level of effort (in person-days) expended for each facility.

6.4 Dealer Incentive

6.4.1. Background and Key Objectives

Over the past several months, RMA has conducted research on EEMs in India. The scope of this research has included all major end-use and technology categories (i.e., lighting, motors, motor drives, HVAC, and residential appliances). From this research, RMA has concluded the following:

- A wide range of EEMs is presently available in India. Equipment representing the major end-use and technology categories is available throughout India.

- This equipment is generally available at reasonable cost to customers.

- Although the equipment is available in-country, it is not available in every community. For example, many of the equipment manufacturers have distributors in Bombay, but not Ahmedabad. This presents a major barrier for DSM in Ahmedabad, as AEC's customers must currently travel about two hundred miles to purchase this equipment. Even if Bombay distributors are willing to ship the equipment to Ahmedabad, the lack of local dealers also makes it difficult for AEC's customers to become aware of the characteristics and benefits of energy-efficient equipment applicable to their facilities. In addition, once they purchase and install the EEMs, it is difficult to maintain and repair the equipment.

- This equipment supply situation represents the classic "chicken and egg" problem. Since there has been no market (i.e., no demand) for EEMs in Ahmedabad in the past, equipment suppliers have not stocked EEMs there. However, the lack of local equipment suppliers also prevents a market from developing in Ahmedabad. It therefore represents a powerful barrier to the development of such a market.

- To remedy this situation, two actions are needed. First, local equipment dealers must change their equipment supply to regularly include EEMs in their inventories. Second, local businesses and residents need to create a permanent market for this equipment by purchasing EEMs when their equipment needs to be replaced.

The DSM Pilot program is designed to stimulate these two actions. The dealer incentive discussed in this section is geared toward changing the equipment supply habits of local equipment dealers. This incentive is designed to provide an inducement for local equipment sellers to both stock and sell high volumes of EEMs. Initially, AEC intends to offer this incentive during the first year of the DSM Pilot Program. This short-term approach reflects their belief that once the equipment dealers begin to carry and sell EEMs, they will continue this behavior (without the benefit on an incentive) after a local market for the equipment is created.

The key objectives of the dealer incentive are to: (1) make EEMs accessible for (local) purchase by AEC’s customers, (2) permanently change the equipment supply-related habits of equipment sellers in AEC’s service territory so that they regularly supply EEMs along with standard-efficiency equipment, and (3) provide an incentive for equipment sellers to maximize sales of EEMs and, in so doing, perhaps lowering the price of such equipment to customers.

6.4.2.   Design of Dealer Incentive

The Dealer Incentive has the following major elements:

- The amount of incentive provided to each equipment dealer is based on actual EEM sales volumes and the estimated energy savings from each type of equipment.

- The amount of the incentive is also based, in part, on the dealer's cost of financing the EEM for one year. This is done to compensate dealers for their costs of stocking the EEM, in case it does not sell right away.

- A schedule of illustrative dealer incentive levels is provided in *Table 6.1*. These values were developed based on each EEM's estimated energy savings level as well as its cost.

The Dealer Incentive will be evaluated for its effectiveness at the end of the first six months and again at the end of the second six months. Following this second evaluation, a recommendation will be made regarding whether to terminate the incentive (as planned), continue the incentive at reduced levels, or apply the incentive to other EEMs.

6.4.3.   Administration of the Dealer Incentive

The Dealer Incentive requires a set of administrative procedures to be developed and followed to ensure that the incentive is working as designed. Procedures (and related materials) are needed to prequalify equipment for the incentive, document equipment sales by dealers, estimate energy savings associated with these sales, and store data related to these issues.

The following are recommendations for specific activities which address these areas. These activities will need to be completed by AEC, with technical assistance by RMA, to ensure that the Dealer Incentive is working properly:

- Develop technology specifications such that minimum requirements are set for incentive eligibility. In addition to minimum efficiency requirements, consideration should be given to power quality, ease of removal, ease of overriding, theft, and quality of construction. These will help to ensure that a quality product is purchased and installed by the customer and that the product will last for its entire estimated lifetime.

- Specify database elements required for tracking, incentive processing and payment, program administration, and future evaluations. These elements may include –

Customer characteristics (firmographics)	Installation service address
Company contact person	Vendor firmographics
Invoice date and number	Equipment installation date
Quantity of equipment installed	Size of equipment installed
Estimated kW savings	Equipment costs
Estimated kWh (on- and off-peak) savings	Annual equipment hours of operation
Motor efficiency, rpm, type, and voltage	Equipment model number and manufacturer

- Develop incentive application procedures and application forms.

- Develop a tracking database and process for fulfillment of incentive payments to vendors and dealers.

- Develop a preliminary workplan for future evaluation activities.

- Develop procedure for “spot-checking” to ensure that equipment for which an incentive was paid actually was installed.

Table 6.1 Schedule of Illustrative Dealer Incentive Levels (based on energy and demand savings)

INDUSTRIAL MOTORS	Motor Size (kW)	(HP)	Incentive (Rs./unit)
Motor 1 - 5 hp			
Efficient motor	2.2	3.0	70
Adjustable speed drive	2.2	3.0	754
Motor 5 - 10 hp			
Efficient motor	5.6	7.4	170
Adjustable speed drive	5.6	7.4	1,864
Cogged v-belts	5.6	7.4	31
Motor 10 - 15 hp			
Efficient motor	9.3	12.4	406
Adjustable speed drive	9.3	12.4	4,546
Cogged v-belts	9.3	12.4	57
Motor 15 - 25 hp			
Efficient motor	14.9	19.8	508
Adjustable speed drive	14.9	19.8	7,071
Cogged v-belts	14.9	19.8	88
Motor 25 - 55 hp			
Efficient motor	29.8	39.5	950
Adjustable speed drive	29.8	39.5	13,683
Cogged v-belts	29.8	39.5	
Motor > 55 hp			
Efficient motor	55.9	74.1	1,372
Adjustable speed drive	55.9	74.1	25,246
Cogged v-belts	55.9	74.1	210

6.5 Financing Information Package

6.5.1. Background and Key Objectives

The lack of financing is a common barrier to implementation of recommended ECOs. Customers may lack information about the availability of capital and the various types of financing. In a very few cases, the customer may not be credit-worthy enough to qualify for the financing which is available.

RMA has held discussions with representatives of various types of businesses and financial institutions in India and has concluded that capital is generally available throughout India. However, lack of information may still be a common barrier. The purpose of the Financing Information Package is to minimize the likelihood that lack of information about available financing options will lead to the failure to install the recommended EEMs.

6.5.2. Materials to be Provided

The Financing Information Package provides a complete set of information about financing options which are available in Ahmedabad. For each local financial institution, the following types of information are to be included in this package:

- Terms and conditions of loans, including interest rates, term of loan (in months or years), down payment requirements, and other related information.

- List of local financial institutions interested in the program, with contact names and phone numbers.

- Loan application forms, as well as a listing of information required for the loan application

6.6 Target Market

Initially, AEC will use early responses from its end-use survey to identify target customers for this program. The goal is to review the individual customer's specific responses and identify high energy-users receiving service under the LT tariffs. These high energy-users are AEC's first priority for marketing the DSM Pilot Program. The rationale behind targeting high energy-users is that, generally, customers with high energy use have the potential to save the largest amounts of energy. Investments which save large amounts of energy tend to be the most cost-effective.

7. BUDGET FOR DSM PILOT PROGRAM

A five-year budget has been developed for the DSM Pilot Program. At AEC's request, the budget includes only those expenses which are directly attributable to the program. Therefore, these represent costs associated with resources which cannot be shifted to another area of the company when the DSM pilot program is over. For example, the costs associated with the end-use equipment saturation survey and start-up of the DSM Cell have not been included.

The budget for the DSM Pilot Program was developed jointly by RMA and AEC. This budget was developed using a "bottoms-up" approach and using local labor rates, equipment costs, and fees charged by other firms involved (such as the energy auditing firm or an advertising agency), where appropriate. For some expense categories (such as the amount budgeted for the dealer incentive), it was necessary to use expert judgment to estimate the expense level because there is no history to draw upon. The goal was to develop a budget which was as realistic as possible and would serve as a tool for AEC management to make decisions regarding the various DSM Pilot Program expenditures.

In order to develop the program budget for subsequent years, it was necessary to classify the expenses as one-time (i.e., first-year) or recurring. For example, training costs are only incurred during the first program year. In addition, equipment-related expenses (such as the cost of the energy audit van) were depreciated over the life of the equipment so there is a depreciation-related expense during each year of the program.

An annual escalation rate of 10% was used to estimate recurring program expenses for future years. A 15% annual interest rate was used to estimate financing costs for capital equipment such as the audit equipment and van. Finally, the total program budget was inflated by 10% at the end of this process to account for uncertainty in the estimates.

Table 7.1 contains the components of the estimated budget for the DSM Pilot Program for the first five years of the program. The budget is highest during the first year of the program when an outside energy auditing firm is retained to provide on-the-job training to AEC staff on energy auditing procedures and when a major advertising campaign is used to publicize the program. The budget starts out at 2.8 lakhs rupees (about $US 73,000) during the first year of the program and drops down to about half this level in subsequent years. It should be noted that a portion of the program's expenses will be paid for by participating customers through charges for energy audits. This proportion is, as yet, unknown and has not been reflected in any of the budget figures. *Table 7.2* provides the complete DSM budget for all of the DSM programs which AEC plans to implement during the next five years. The five-year budget for the DSM Pilot Program is the first item in this table.

Table 7.1 Estimated Budget for the DSM Pilot Program (in Rupees)

Table 7.2 5-Year DSM Budget

8. COST-EFFECTIVENESS OF THE DSM PILOT PROGRAM: ANALYSIS AND RESULTS

8.1 Introduction

Since a qualitative, rather than quantitative, screening process was used to select the DSM Pilot Program, cost-effectiveness has not yet been considered in the formal program screening process. In this section, the costs and benefits of the Pilot Program are quantified and the results of this analysis are presented. Cost-effectiveness is assessed from three different points of view: end-users (participating customers), the utility, and society.

8.2 Cost-Benefit Perspectives

It is important to evaluate the cost-effectiveness of the DSM Pilot Program from multiple perspectives, to assess whether or not the program is beneficial to all affected parties. There are three key groups affected by the DSM Pilot Program: participating customers, society, and the utility. Three cost-benefit perspectives, reflecting the financial impacts of the program on these three key groups, were assessed. These perspectives are discussed below.

Participant Perspective - The Participant perspective (or "test") measures the quantifiable benefits and costs to the customers resulting from their participation in a DSM program. Since many customers do not base their decision to participate in a DSM program entirely on quantifiable information, this perspective does not provide a complete measure of all of the benefits and costs of a program which accrue to the customer.

The *benefits* to the participating customer include the reduction in the customer's energy bills, as well as any financial incentives or tax credits accrued by the customer. The *costs* to the customers are their out-of-pocket expenses incurred because of their participation in the program. These include the incremental cost of EEMs and/or related services, any incremental, ongoing operation and maintenance expenses, equipment removal costs net of its salvage value, and installation costs.

Because the Participant Perspective considers all of the pertinent costs and benefits involved over the life cycle of the equipment involved, it is important to consider its results. However, it alone is not sufficient, as it does not capture all of the information considered in the customer's decision-making process. A second, equally important index is the simple payback period of the EEM. The simple payback period indicates how long (in months or years) it takes for the customer's initial investment to be repaid through bill reductions following their investment in EEMs. In general, most customers require a simple payback period of three years or less in order to invest in ECOs.

Total Resource Cost Perspective - This perspective evaluates the program as a resource option for society as a whole. Essentially, this perspective compares the cost of the demand-side alternative with the cost of the supply-side alternative (i.e., "business as usual"). This test captures all of the costs and benefits involved in the decision to implement a DSM program over other supply-side alternatives and, as such it is very important to consider. It should be noted that, in general, this perspective is the most difficult for DSM programs to pass.

The *benefits* to society are the avoided costs of the supply alternative. For AEC, these are defined by their savings in purchased power costs (because of the program) over the DSM Pilot program life cycle. These are calculated using the tariff which AEC pays the GEB. In some variants of this test, the benefits are expanded to include the value of reduced pollution because of the DSM program. This variant has not been considered in this report because of the difficulty of quantifying the value of reduced air pollution.

The *costs* in this case are the expenses associated with the resources directly involved with the DSM program. These include the cost of EEMs, EEM installation costs, the cost of equipment removal less its salvage value, and DSM program administrative costs.

The value of the Total Resource Cost Test derives from its very broad scope. The Total Resource Cost perspective is the only test in which costs and benefits from multiple parties' perspectives are captured. Because of this, it is important that the DSM programs be screened first against this perspective for their cost-effectiveness before they are considered any further.

Utility Cost Perspective - The Utility Cost perspective evaluates the costs and benefits of a DSM program from the standpoint of the program's impact on the utility's revenue requirement. For the utility, this test is key because it provides information regarding whether the DSM program is less costly that other supply-side alternatives.

The *costs* to the utility are the direct DSM program-related expenses. Virtually all of these are captured in the utility's budget for the DSM program which includes financial incentives (if any), equipment costs, administrative costs, advertising expenses, marketing costs, and other types of costs directly associated with the implementation of the program.

The *benefits* to the utility are a function of the cost it avoids by reducing its use of its supply-side resources (for AEC, purchases from the GEB). Thus, the benefits under this perspective are identical to those considered in the Total Resource Cost test.

Table 8.1 presents the cost and benefit terms for each of these perspectives in tabular format.

Table 8.1 Costs and Benefits Used in Various Perspectives

Costs	PERSPECTIVES		
	Participant	**Total Resource Cost**	**Utility Cost**
1. Energy-Efficient Equipment Cost			
2. Installation Cost			
3. Operations & Management			
4. Removal Costs Less Salvage Value			
5. DSM Program Administrative Costs			
6. Financial Incentives			
Benefits			
1. Avoided Purchased Power Costs			
2. Financial Incentives			
3. Bill Savings			

8.3 Cost-Benefit Analysis of DSM Pilot Program

To compute the costs and benefits of the DSM Pilot Program under these three perspectives, RMA developed a simplified cost-benefit screening model using a PC-based spreadsheet program (Quattro Pro for Windows™). For AEC, it was not necessary to do this analysis using an hourly cost-benefit model such as those commonly used by U.S. electric utilities (for example, DS Manager™ or COMPASS™) since AEC has only one avoided resource cost: purchased power. As long as AEC's purchased power cost tariff can be accurately characterized on a simpler spreadsheet-based model, it is possible to analyze the DSM Pilot Program's costs and benefits using this much simpler tool. This spreadsheet-based, cost-benefit tool will be turned over to AEC staff and be used to provide user-friendly training of DSM staff on cost-benefit analysis of DSM programs.

8.3.1 Avoided (Purchased Power) Cost Determination

To compute the value of purchased power saved by various types of EEMs, RMA performed a detailed analysis of AEC's purchased power tariff as well as its purchased power costs during the last 18 months. Purchased power costs were separated into energy and demand-related charges and stratified by on-peak and off-peak periods. AEC provided:

- Its current purchased power tariff from the GEB, plus various amendments it has negotiated to the tariff.

- Its purchased power bills for the past 18 months.

- Its average escalation in the average cost of purchased power during the past 24 months.

The following observations, pertinent to DSM programs, can be made from the detailed analysis of AEC's purchased power costs during the last 18 months:

- Energy charges are a very dominant part (about 85%) of AEC's total purchased power cost; this will tend to favor DSM programs which save both energy and demand over those which save demand only.

- Based on AEC's monthly average purchased-power cost, per-kWh costs increase significantly during those months when its own generating units are off-line. During these months, the demand component of its purchased-power cost increases substantially, rising to up to 40% of its total cost. AEC should develop energy efficiency programs and load management programs which effectively provide load relief during these periods, so that it can avoid paying these excessive charges.

- Overall, AEC's purchased power costs are increasing very rapidly. This means that future DSM programs should be even more cost-effective than they are today. According to AEC, this is due, in part, to the fact that both coal and rail costs are rising rapidly nationwide. Both of these costs account for a significant proportion of the overall power supply cost structure of AEC's power supplier, the GEB.

From this information, RMA was able to prepare a schedule of AEC's purchased power cost savings for EEMs with different hardware lives (*Table 8.2*). This schedule reflects the current structure of AEC's purchased power tariff and the various charges within the tariff. Purchased power cost savings are provided for a generic 1 kW, 100% load factor reduction in load; these can be scaled to the actual savings and actual load factor of the technology being considered. The values in this analysis reflect a nominal escalation rate of 20.5% per year and an annual discount rate of 11% (or a real escalation rate of 9.5%).

Table 8.2 Calcualtion of Life Cycle Purchased Power Cost Savings
(For EEMs with Different Lives)

Table 8.2 (Continued)

8.3.2. Escalation and Discount Rate Assumptions

RMA used an escalation rate of 11% per year to inflate all costs, other than purchased power, out to future years. As noted above, purchased power costs were inflated at 20.5% per year, based on AEC's recent experience. All costs (expressed in future value) were then discounted at 11% per year. These values were all set based on discussions with AEC regarding its actual experience in each of these areas. All costs were expressed in the base year (1995) dollars.

8.3.3. DSM Program Administrative Costs

Administrative costs for the DSM Pilot Program were developed from the Program budget discussed in Section 7. Administrative costs represent expenses which are <u>directly assignable</u> to the DSM Pilot Program The following expenses are included in this category:

- Labor-related costs for performing the audits and feasibility studies and managing the program

- Expenses related to training AEC staff to perform these audits and feasibility studies (including the cost of hiring an outside auditing firm to train AEC staff on-the-job in the early months of the program)

- The cost of incentives provided to local equipment dealers during the first year of the program

- Advertising expenses

One unique feature of this program is that, in many cases, participating customers are charged for the audits and feasibility studies performed in their facilities. The fees charged are designed to reflect the costs of providing these services, such as the cost of the auditor's time, a portion of the expenses related to training, auditing instruments, and energy van, etc. Although we expect that a portion of the audited customers will be charged for these services, there is no history to indicate what this portion should be. Therefore, DSM Pilot Program costs have not been reduced to reflect this payment by customers.

RMA needed to analyze the cost-effectiveness of the DSM Pilot Program in the context of various actions taken by participating customers, such as replacing worn-out equipment with energy-efficient equipment or improving operations and management (O&M) procedures. Thus, it was necessary to develop a method for allocating the administrative costs of the program back to these customer actions. To make this allocation, RMA developed a formula which expresses the administrative costs of the program as a function of the energy and demand savings resulting from these customer actions. (To compute the per-kWh and per-kW factors contained in the formula, RMA used the annual energy and demand savings goals discussed in Section 9 in the calculation.) The resulting formula is as follows:

- Administrative costs per EEM =
  0.41 Rs/kWh x Number of Years of Energy Savings + 32.0 Rs/kW/month x 12 months x Number of Years of Energy Savings

The advantages of this approach to determining administrative costs are two-fold: (1) it ties the administrative costs to the administrative cost budget and therefore provides some assurance that the cost-benefit analysis of the program will fully consider all pertinent program costs in the calculations, and (2) the use of a formula makes it relatively easy to analyze the sensitivity of the results to program revisions (e.g., changes to the annual budget or annual energy/demand savings goals).

8.3.4. Energy-Efficient Equipment Costs

During 1994-1995, RMA and AEC researched the present state of EEMs supplied in India. The objectives of this research were to:

- Confirm that a wide range of EEMs, addressing all major end-use and technology categories is available in-country.

- Provide data needed for the cost-effectiveness analysis of the DSM Pilot Program, such as the equipment cost, energy/demand savings, and the equipment life.

- Provide information on the general business climate for EEMs in India which could be shared with U.S. businesses interested in partnering and joint-venture opportunities.

A detailed Business Focus Report will be completed by the end of the year which summarizes the findings of this research effort. (This report is being developed through the Energy Audit Improvement component of the EMCAT Project.) However, information pertinent to the cost-benefit analysis of the DSM Pilot program will be presented in this report.

Through this research, RMA and AEC have found that a wide range of EEMs is presently available in India. In general, the efficiency of the EEMs available in India is lower than those oavailable in the U.S., Europe, or Japan. To simplify the data collection process, RMA and AEC's research tended to focus on the very large equipment manufacturers, such as Crompton-Greaves, Philips-India, and Kirloskar. All of these firms produce an energy-efficient product line for the end-use(s) in which they specialize.   RMA assumed that their products were representative of the EEMs typically available in India and utilized data related to these products in its cost-benefit analysis. *Table 8.3* summarizes the EEM data used by RMA to analyze the cost-effectiveness of the DSM Pilot Program.

8.4 Results of Cost-Benefit Analysis of DSM Pilot Program

RMA found the DSM Pilot Program to be cost-effective overall and for a wide range of EEMs likely to be promoted through the incentive and audit programs. In order for a measure to be cost-effective, it was required to satisfy the following criteria:

- Pass the Total Resource Cost Test (i.e., have a Benefit-Cost ratio of one or greater)
- Pass the Utility Cost Test
- Pass the Participant Test
- Have a simple payback period of three years or less

The vast majority of the EEMs analyzed by RMA satisfied the above criteria. For the industrial sector (the subject of the DSM Pilot Program), a large number of EEMs addressing the motors end-use were cost-effective, as were many EEMs for the lighting end-use. *Tables 8.4* and *8.5* present the quantitative results of the cost-benefit analysis performed by RMA for the EEMs which were analyzed. In *Table 8.4*, the Benefit-Cost Ratios and Simple Payback periods are presented for each of the EEMs screened. *Table 8.5* contains additional information on the energy saved by the measure as well as the cost savings resulting from the installation of each EEM. In the next section of this report, the results of this economic screening will be presented in another way, as estimates of economic energy savings potential.

Table 8.3 Energy-Efficient Measures Data

Table 8.3 (continued)

Table 8.4 Cost-Benefit Ratios and Simple Paybacks for Individual Sector EEMs

Table 8.5 Cost, Savings, and Life Estimates for Industrial Sector EEMs

9. ANNUAL ENERGY AND DEMAND SAVINGS GOALS

Annual energy and demand savings goals are estimates of the amounts of electricity (kWh and kW) which AEC can expect to save through the implementation of the DSM Pilot Program. For AEC, every kWh and kW saved is one less kWh and kW they would need to purchase from the GEB. RMA used a two-step process to estimate savings goals for AEC. First, RMA estimated technical and economic savings potential for AEC overall. Second, savings attributable to the program were estimated based on a combination of RMA's experience with energy audits and the results of RMA's analysis of economic DSM savings potential for LT Industrial customers. The following sections provide a detailed description of this process.

9.1 Calculation of Technical and Economic Savings Potential

Technical savings potential is defined as the net electricity savings which could be achieved by replacing all existing end-use technologies with the most energy-efficient equipment whenever it is technically feasible as the standard technologies wear out.. Efficient measures are installed irrespective of their cost. It is assumed that unlimited quantities of energy-efficient devices are available and a large engineering staff is readily available to install the devices. Estimates of technical potential provide an absolute upper-bound on the amount of energy savings which could be achieved by the utility under the most favorable of circumstances, but they are not practical for any other use. *Economic savings potential* represents energy savings which is both technically and economically feasible for a utility and its customers. Estimates of economic savings potential are far more useful as they are based on normal equipment replacement intervals and cost-effectiveness constraints. Economic potential calculations can also incorporate other barriers in the marketplace, such as lack of energy-efficient equipment and lack of available financing.

In order to estimate technical and economic electricity savings potential, RMA developed the End-Use Technology DSM (ETD) Model. The ETD Model is a tool which allows the user to identify cost-effective EEMs and forecast the measures' potential savings and penetrations for various customer subgroups. The model has two main components: the Technical Assessment Module and the Economic Assessment Module. Technical savings potential is estimated within the first component of the model and economic savings potential is computed within the second component. Each of these components are discussed below.

The ETD Model performs the following functions:

- It calculates the technical energy savings potential based on the level of activity in each customer subgroup and the number of eligible equipment applications for the years 1995 to 2010.

- It computes both the total and incremental capital cost over the life of the EEMs.

- It performs a cost-benefit screening of the EEMs from the point of view of the end-user, the utility, and society.

- It estimates economic savings potential based on the results of the cost-benefit screening, the number of eligible applications, and the rate at which equipment is normally replaced.

- It ranks the EEMs in the order of increasing cost per kWh saved, generates energy efficiency supply curves, and selects the least-cost set of EEMs based on this ranking.

9.1.1 Energy-Efficient Measures Cost and Savings Analysis

A five-step process was used to identify appropriate EEMs and compute their life cycle cost and energy savings levels as well as the per-unit cost of saved energy over the equipment's life.

First, criteria were used to identify the set of EEMs which would be considered as candidates for promotion through a DSM program. The EEMs had to be available in India. Only EEMs for major end-use categories were considered. In the industrial sector, motor and lighting end-use categories were considered. Together, these account for about 85% of the usage for the industrial sector. For the residential sector, efficient lighting systems, HVAC measures (window air conditioners and evaporative coolers) and appliances (i.e., refrigerators, hot water heaters, and fans), which account for about 85% of total consumption, were analyzed. The lighting, HVAC, and pumping end-uses were included in this study for the service sector, since they address about 95% of the sector's energy needs. The pumping and lighting end-uses were addressed for the agricultural sector as they comprise nearly 100% of the sector's electricity requirements. *Table 9.1* lists the EEMs analyzed in the ETD Model.

Second, data characterizing existing conditions <u>before</u> application of the EEM, were compiled for each potential application. The following types of data were needed: the saturation of various types of electricity-using equipment; annual electricity consumption associated with each type of equipment, the capital and operating costs of the existing (standard-efficiency) equipment, and the life of the existing equipment. Because this analysis presumes that energy savings will occur as existing standard efficiency equipment is replaced by EEMs, it is also useful to know the age of the existing equipment in order to predict when the equipment replacements will occur.

Third, the total and incremental costs of the EEMs were computed. Total capital cost is defined as the cost to purchase, install, and maintain the EEM over its useful life. Incremental cost represents the difference between the total costs of the EEM and the total costs of the standard- efficiency technology. When both installation and maintenance costs for the standard-efficiency technology and the EEM are similar, they were not included. In cases where the EEM is a control system or device which is added (such as adjustable speed drives), the total and incremental costs are the same because nothing is being replaced. Additionally, the incremental costs are negative in some instances, for example, when conversion to energy-efficient equipment is paired with downsizing of the equipment, in which case, there is an overall cost savings.

Fourth, the annual and life cycle energy savings of the EEM was calculated. The annual energy savings represents the difference between the estimated annual electricity consumption of the standard-efficiency equipment, with line losses included, and that of the EEM. Thus, the resulting energy savings figures represent energy saved at the point of generation, rather than the end-user.

Fifth, the cost-effectiveness of the EEMs was computed. Benefit-cost ratios were calculated for the three perspectives described earlier, and the simple payback period of the EEM for the end-user was calculated. In addition, the cost of saved energy was computed. The cost of saved energy equals the 15-year net present value of the incremental cost of the EEM (which includes installation, maintenance, and replacements as needed) divided by the 15-year discounted kWh savings. Utility administrative cost and incentives or rebates are not included in the calculation. Because the cost of saved energy has been calculated at the power supply level, it is directly comparable to AEC’s avoided costs (i.e., their purchased-power costs) discussed in Section 8.

9.1.2 Estimates of Technical and Economic Potential

Table 9.1 presents a summary of RMA's estimates of Technical and Economic electricity savings potential for AEC. Several important observations can be made from the data in this table.

For the estimates of Technical Potential:

- The energy (kWh) savings represents about 17% of AEC's annual sales, while demand (kW) savings represents a much smaller fraction, about 7%, of AEC's annual system peak demand.

- Most of the Technical electricity savings potential is associated with the lighting end-use. A much smaller fraction is for the motors and appliances end-uses. This is because EEM lighting savings per replacement can be as great as 75%, while, per replacement, motor savings are typically less than 5%. Also, lamps have a far shorter life than motors, thus a larger fraction of their total number can be replaced each year.

- Most of the Technical savings potential is concentrated in the residential sector and the lighting end-use within that sector. This is not surprising, given the large number of residential customers served by AEC and the large amount of inefficient lighting used by residential customers.

Table 9.1 Estimates of Technical and Economic Potential

For the estimates of Economic Potential:

- The energy (kWh) savings potential represents about 5% of AEC's annual sales, while demand savings potential is only about 2%. The reduction in these values reflects the results of the cost-effectiveness screening,the normal replacement cycle of inefficient devices, and RMA's judgment that the pool of eligible customers in certain sectors (e.g. residential) would be limited by the customers' lack of income to purchase EEMs.

- The breakdown of Economic savings potential by major end-use and customer group follows the same pattern as for Technical potential (and for the same reasons). Lighting is the dominant end-use and residential is the dominant customer sector.

In general, these estimates suggest that the Economic savings potential within a given year is small. This is partly because the ETD model assumes that all currently operating devices are as efficient as new standard-efficiency devices. Utility savings should be greater as old, inefficient devices (operating well below the efficiency of today's standard technologies) are replaced by EEMs. It is also the case that the savings potential is much greater over many years, because of the cumulative effect of equipment replacements. Savings will also accrue through time as new and more efficient EEMs enter the Indian market and as low- and no-cost ECOs and new technologies are recognized and implemented.

Appendix C provides detailed work papers which support and explain these calculations of Technical and Economic Savings Potential.

9.2 Development of Annual Energy and Demand Savings Goals

Annual energy and demand savings goals are estimates of the amount by which AEC’s energy and capacity supply requirements could reasonably be reduced because of the DSM program. They are tied to the level of EEMs which are purchased and installed in a given year and are typically expressed as energy (kWh) and peak demand (kW) saved within a given year. These goals are valuable for:

- Rationalizing the DSM program budget to senior management who may wonder "what are we getting for what we’re spending?"

- Analyzing the cost-effectiveness of the proposed program(s).

- Providing a basis for acquiring human and financial resources to support the program, such as staff, equipment, promotional materials.

- Supporting the company’s integrated resource planning efforts.

The magnitude of the company’s annual energy and demand savings goals is influenced by a number of factors. The most significant influences are the customers’ current energy-use levels and potential for saving energy, the specific design and incentive level of the DSM program, the aggressiveness with which the program is promoted by the utility, the level of energy prices, the degree to which energy-efficient devices and practices have been installed and implemented absent a DSM program, the availability of EEMs locally, and the availability of local financing.

Annual Energy and Demand Savings Goals for DSM Pilot Program

For the DSM Pilot Program, the computation of goals was straightforward. Goals were based on the types of equipment likely to be replaced through the program, the number of units of equipment eligible for replacement each year, and an estimate of the proportion of eligible units likely to be replaced by EEMs because of the program. The following procedure was used to compute goals for the DSM Pilot Program:

- First, the motors and lighting end-uses were identified as those most likely to be addressed by the DSM Pilot Program.

- Second, from the assessment of technical and economic potential, kWh/year and kW savings amounts were identified for the motors and lighting end-uses (within the industrial sector). These amounts represent the savings which could be achieved if 100 percent of the units eligible for replacement are replaced with EEMs during 1995.

- Third, these savings potentials were scaled down substantially to reflect the level of activity possible through the DSM Pilot Program during the first year. To make this calculation, RMA estimated that the program would be able to capture savings assuming:

    * 100% of annual eleigible motor, pumps, fans and compressors
    * 50% of annual eligible commercial and service sector lighting
    * 25% of annual eligible residential and agricultural lighting, appliances and HVAC
    * 20% of annual eligible industrial lighting is replace by EEMs.

- Fourth, RMA estimaed that the Pilot Program would be able to capture two percent of the scaled-down savings potnetial during the first year of the program. The energy and demand savings goals are as follows:

Energy	399,395 kWh
Demand	75.2 kW

These penetration goals are ambitious for AEC, which is in the very early stages of DSM implementation. Because there is no prior history to draw upon, this goal-estimating process is dependent upon judgment and assumptions, rather than actual data. It will be very important for AEC to closely monitor the actions taken by audited customers as well as the local sales of EEMs by dealers, to determine whether these goals are still appropriate six months after the inception of the DSM Pilot Program.

10. IMPLEMENTATION REQUIREMENTS

10.1 Training of AEC Staff

Initially, AEC is contracting with an outside firm, PDTC based in Rajkot, to accompany their staff to customer sites and perform energy audits. Through this approach, AEC staff will be trained on audit techniques on-the-job as audits are being performed. AEC expects PDTC to provide standard software, report formats, industry information, and other pertinent information. PDTC will also provide audit equipment, energy buses, etc. that they use normally. At the end of 12 months, AEC staff will be self-sufficient and in a position to perform these audits on their own.

Additionally, engineers in AEC's Power Services Division (PSD) are being trained to perform energy audits and feasibility studies for AEC's customers. These engineers are being trained on-the-job through an outside firm (as noted above) as well as through the formal classroom-based Energy Auditor training provided through the EMCAT project. Once they are trained, these PSD engineers are available for hire by AEC or outside firms.

10.2 Equipment Requirements

Within six months of the start of this program, AEC plans to purchase a complete set of standard audit equipment as well as an energy auditing van. AEC is in the process of procuring many of the energy auditing instruments through the Energy Audit Improvement component of the EMCAT Project.

10.3 Staff Requirements

A minimum of two trained auditors are required to implement this program. These trained auditors need to be skilled in both engineering and financial analysis. They would also need to be trained in energy auditing techniques. AEC also plans to assign an Electrician/Driver to this program.

10.4 Marketing Approach

Initially, AEC plans to use LT customers’ responses from the end-use survey to identify marketing targets for this program. Through the survey process, eighteen of AEC’s industrial customer have already expressed interest in having an energy audit done. Individual customers' specific responses will be reviewed and high energy users within the LTP and LT-Motor Drive categories will be identified. AEC will supplement this review with an analysis of its billing data for LT customers to identify additional candidates for the program. These high energy-users are the first priority for marketing.

After these high-priority customers have been identified, AEC will contact them in writing to explain the program and how the customer would benefit. If customers indicate they are interested in having an audit done, AEC will contact them directly and set up an appointment for an audit. If AEC gets low or no responses from the postcard, they will need to follow-up with personal phone calls.

AEC also intends to contract local trade associations such as Gujarat Chamber of Commerce, ATMA, ATIRA, Industrial Estate Associations, CII, and Ice Manufacturers and Cold Storage Associations to find out when their meetings are. AEC will then attend meetings on a regular basis and use these as a vehicle for publicizing their programs.

10.5 Advertising

AEC is developing a set of written materials (flyers and brochures) to explain the program to customers and equipment dealers). After the program has been in effect for about one year, AEC will develop marketing materials which describe success stories (i.e., experiences of individual customers) to further promote the program. AEC also plans to develop a videotape explaining the program for use at trade association meetings.

11. MONITORING AND EVALUATION

Monitoring and evaluation activities are needed to follow-up with customers whose facilities have been audited in order to promote their adoption of the audit recommendations and to verify the estimates or energy and demand savings, as well as the cost-effectiveness of the DSM Pilot Program. The proposed monitoring and evaluation tasks are designed to be relatively simple and straightforward, so that they can be easily conducted by AEC staff without a lot of technical training. Information obtained through these activities will provide AEC with insight into the effectiveness and success of the DSM Pilot Program at various stages of its implementation From these tasks, AEC should have more than enough information to verify the effectiveness of the program. These tasks are as follows:

1. *AEC will contact customers whose facilities are audited at least once per month after the audit and feasibility study have been completed.* The purpose of these contacts is two-fold: to promote the recommendations made in the audits (for those that the customer has not yet acted upon) and to collect information on actions the customer has already taken. If the customer indicates that some or all of the actions recommended in the feasibility study have been implemented, AEC will collect information from them describing the characteristics of three types of equipment: that which was previously used by the customer, the new energy-efficient equipment, and the equipment the customer would have purchased absent the program. This information, plus data from the energy audit feasibility studies (such as hours of use for the equipment), should allow AEC to compute the energy and demand savings realized by the program for each action taken.

2. *AEC will contact the local equipment dealers and motor rewinding firms participating in the dealer incentive at least monthly to collect information about their actual sales of EEMs.* This activity not only helps with the monitoring and evaluation of the program, it also provides information needed for the administration of the dealer incentive. AEC will be able to use the data from these contacts with equipment dealers to assess the effectiveness of the dealer incentive in promoting sales of EEMs to all of AEC's industrial customers, not just to those customers who have had their facilities audited.

APPENDIX A
AEC Survey Forms

APPENDIX B
DSM Program Ideas

APPENDIX C
Work Papers Used to Develop Estimates of Technical and Economic Potential